Questions 14, 21, 22, 27-31 odd, 37 – 53 odd, 55b, 110

14. You would not get a single mass of 12.011. That is only an average of the naturally occurring isotopes of carbon.

21. \$6.022 x 10^{23} / 6,000,000,000 = \$1 x 10^{14} per person

22. Molar mass is the mass of a whole molecule (in grams), whereas empirical formula mass is based on the simplest whole number ratio of elements in a compound. They would be different if the molecular formula was a multiple of the empirical formula. For example, C_2H_4 has an empirical formula of CH_2. The molar mass is always a whole number multiple of the empirical formula mass.

27. 0.0140 x 203.973 amu = 2.86 amu
0.2410 x 205.9745 amu = 49.64 amu
0.2210 x 206.9759 amu = 45.74 amu
0.5240 x 207.9766 amu = 108.98 amu
207.22 amu Pb

29.
186.207 amu
0.6260 x mass of 186.956 = - 117.034 amu
0.3740 x mass of Re-185 = 69.173 amu

Mass of Re-185 = 184.95 amu

31. 0.2534 x 157.84 amu = 40.00 amu
0.5000 x 159.84 amu = 79.92 amu
0.2466 x 161.84 amu = 39.91 amu
159.83 / 2 = 79.92 amu

The average atomic mass a single Br atom is 79.92 amu

assignment 3.1

33. $\dfrac{500.\text{ atoms Fe} \mid 1\text{ mol Fe} \mid 55.85\text{ g Fe}}{\mid 6.022 \times 10^{23}\text{ atoms Fe} \mid 1\text{ mol Fe}}$

$= 4.64 \times 10^{-20}$ g Fe

35. $\dfrac{0.200\text{ g C} \mid 1\text{ mol C} \mid 6.022 \times 10^{23}\text{ atoms C}}{\mid 12.011\text{g C} \mid 1\text{ mol C}}$

$= 1.00 \times 10^{22}$ atoms

37. $Al_2O_3 = 2(26.98) + 3(16.00) =$ ***101.96 g/mol***
$Na_3AlF_6 = 3(22.99) + 26.98 + 6(19.00) =$ ***209.95 g/mo***l

39. a. $NH_3 = 14.01 + 3(1.008) =$ ***17.03 g/mol***
b. $N_2H_4 =$ ***32.05 g/mol***
c. $(NH_4)_2Cr_2O_7 =$ ***252.08 g/mol***

41. a. $\dfrac{1.00\text{g } NH_3 \mid 1\text{ mol } NH_3}{\mid 17.03\text{ g } NH_3}$ ***= 0.0587 mol NH_3***

b. $\dfrac{1.00\text{g } N_2H_4 \mid 1\text{ mol } N_2H_4}{\mid 32.05\text{ g } N_2H_4}$ ***= 0.0312 mol N_2H_4***

c. $\dfrac{1.00\text{g } (NH_4)_2Cr_2O_7 \mid 1\text{ mol } (NH_4)_2Cr_2O_7}{\mid 252.08\text{ g } (NH_4)_2Cr_2O_7}$ ***= 0.00397 mol $(NH_4)_2Cr_2O_7$***

43. a. $\dfrac{5.00\text{ mol } NH_3 \mid 17.03\text{ g } NH_3}{\mid 1\text{ mol } NH_3}$ ***= 85.2 g NH_3***

b. $\dfrac{5.00\text{ mol } N_2H_4 \mid 32.05\text{ g } N_2H_4}{\mid 1\text{ mol } N_2H_4}$ ***= 160. g N_2H_4***

c. $\dfrac{5\text{ mol } (NH_4)_2Cr_2O_7 \mid 252.08\text{ g } (NH_4)_2Cr_2O_7}{\mid 1\text{ mol } (NH_4)_2Cr_2O_7}$ ***= 1260 g $(NH_4)_2Cr_2O_7$***

assignment 3.1

45. a. $\frac{5.00 \text{ mol } NH_3}{1} \times \frac{1 \text{ mol N}}{1 \text{ mol } NH_3} \times \frac{14.01 \text{ g N}}{1 \text{ mol N}}$ ***= 70.1 g N***

b. $\frac{5.00 \text{ mol } N_2H_4}{1} \times \frac{2 \text{ mol N}}{1 \text{ mol } N_2H_4} \times \frac{14.01 \text{ g N}}{1 \text{ mol N}}$ ***= 140. g N***

c. $\frac{5.00 \text{ mol } (NH_4)_2Cr_2O_7}{1} \times \frac{2 \text{ mol N}}{1 \text{ mol } (NH_4)_2Cr_2O_7} \times \frac{14.01 \text{ g N}}{1 \text{ mol N}}$ **= 140. g N**

47. a. $\frac{1.00 \text{g } NH_3}{17.03 \text{ g } NH_3} \times \frac{1 \text{ mol } NH_3}{1 \text{ mol } NH_3} \times \frac{6.022 \times 10^{23} \text{ units}}{1 \text{ mol } NH_3}$ ***= 3.53 x 10^{22} molecules***

b. $\frac{1.00 \text{g } N_2H_4}{32.05 \text{ g } N_2H_4} \times \frac{1 \text{ mol } N_2H_4}{1 \text{ mol } N_2H_4} \times \frac{6.022 \times 10^{23} \text{ units}}{1}$ ***= 1.88 x 10^{22} molecules***

c. $\frac{1.00 \text{g } (NH_4)_2Cr_2O_7}{252.08 \text{ g } (NH_4)_2Cr_2O_7} \times \frac{1 \text{ mol } (NH_4)_2Cr_2O_7}{1 \text{ mol } (NH_4)_2Cr_2O_7} \times \frac{6.022 \times 10^{23} \text{ units}}{1}$

= 2.39 x 10^{21} formula units

49.

a. $\frac{1.00 \text{g } NH_3}{17.03 \text{ g } NH_3} \times \frac{1 \text{ mol } NH_3}{1 \text{ mol } NH_3} \times \frac{1 \text{ mol N}}{1 \text{ mol N}} \times \frac{6.022 \times 10^{23} \text{ atoms N}}{1}$

= 3.54 x 10^{22} atoms N

b. $\frac{1.00 \text{g } N_2H_4}{32.05 \text{ g } N_2H_4} \times \frac{1 \text{ mol } N_2H_4}{1 \text{ mol } N_2H_4} \times \frac{2 \text{ mol N}}{1 \text{ mol N}} \times \frac{6.022 \times 10^{23} \text{ atoms N}}{1}$

= 3.76 x 10^{22} atoms N

c. $\frac{1.00 \text{g } (NH_4)_2Cr_2O_7}{252.08 \text{ g } (NH_4)_2Cr_2O_7} \times \frac{1 \text{ mol } (NH_4)_2Cr_2O_7}{1 \text{ mol } (NH_4)_2Cr_2O_7} \times \frac{2 \text{ mol N}}{1 \text{ mol N}} \times \frac{6.022 \times 10^{23} \text{ atoms N}}{1}$

= 4.78 x 10^{21} atoms N

51. $C_6H_8O_6 = 6(12.01) + 8(1.008) + 6(16.00) = 176.12$ g/mol

$\frac{0.500 \text{g } C_6H_8O_6}{176.12 \text{ g } C_6H_8O_6} \times \frac{1 \text{ mol } C_6H_8O_6}{1}$ ***= 0.00284 moles***

$\frac{0.00284 \text{ mol } C_6H_8O_6}{1 \text{ mol } C_6H_8O_6} \times \frac{6.022 \times 10^{23} \text{ molecules}}{1}$ ***= 1.71x 10^{21} molecules***

assignment 3.1

53. a. $\frac{150.0\text{g } Fe_2O_3 \mid 1 \text{ mol } Fe_2O_3}{159.70 \text{ g } Fe_2O_3}$ = ***0.9393 mol Fe_2O_3***

b. $\frac{0.010\text{g } NO_2 \mid 1 \text{ mol } NO_2}{46.01 \text{ g } NO_2}$ = ***0.00022 mol NO_2***

c. $\frac{1.5 \times 10^{16} \text{ molecules } BF_3 \mid 1 \text{ mol } BF_3}{6.022 \times 10^{23} \text{ molecules } BF_3}$ = ***2.5×10^{-8} mol BF_3***

55b. $\frac{5.00\text{g } Mg_3N_2 \mid 1 \text{ mol } Mg_3N_2 \mid 2 \text{ mol N} \mid 6.022 \times 10^{23} \text{ atoms N}}{100.92 \text{ g } Mg_3N_2 \mid 1 \text{ mol } Mg_3N_2 \mid 1 \text{ mol N}}$

= ***5.97×10^{22} atoms N***

110. $\frac{0.524\text{g } C_7H_5BiO_4 \mid 1 \text{ mol } C_7H_5BiO_4 \mid 1 \text{ mol Bi} \mid 209.2 \text{ g Bi}}{362.3\text{g } C_7H_5BiO_4 \mid 1 \text{ mol } C_7H_5BiO_4 \mid 1 \text{ mol Bi}}$

= ***0.303 g Bi***

57. a. 14(12.01) + 18(1.008) + 2(14.01) + 5(16.00) =

= 294.30 g/mol

b. $\frac{10.0\text{g } C_{14}H_{18}N_2O_5 \mid 1 \text{ mol } C_{14}H_{18}N_2O_5}{294.30 \text{ g } C_{14}H_{18}N_2O_5}$ = ***0.0340 mol $C_{14}H_{18}N_2O_5$***

c. $\frac{1.56 \text{ mol } C_{14}H_{18}N_2O_5 \mid 294.30 \text{ g } C_{14}H_{18}N_2O_5}{1 \text{ mol } C_{14}H_{18}N_2O_5}$ = ***459g $C_{14}H_{18}N_2O_5$***

d. $\frac{0.0050\text{g } C_{14}H_{18}N_2O_5 \mid 1 \text{ mol} \mid 6.022 \times 10^{23} \text{ molecules}}{294.30 \text{ g} \mid 1 \text{ mol}}$

= 1.0×10^{19} molecules

e. $\frac{1.2 \text{ g } C_{14}H_{18}N_2O_5 \mid 1 \text{ mol} \mid 2 \text{ mol N} \mid 6.022 \times 10^{23} \text{ atoms N}}{294.30 \text{ g} \mid 1 \text{ mol } C_{14}H_{18}N_2O_5 \mid 1 \text{ mol}}$

= 4.9×10^{21} atoms N

f. $\frac{1.0 \times 10^{9} \text{ molecules} \mid 1 \text{ mol} \mid 294.30\text{g}}{6.022 \times 10^{23} \text{ molecules} \mid 1 \text{ mol}}$

= 4.9×10^{-13} g $C_{14}H_{18}N_2O_5$

g. ***4.887×10^{-22} g***